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July 8, 1997

VIA EXPRESS MAIL
Hon. Commissioner of Patents and Trademarks
Washington, D.C. 20231

Re: U.S. Patent Application for "Apparatus and Method For Parallel Transmission of Data Over a Telephone Line"

Dear Sir:

Enclosed please find the following items:

1. a copy of the above-identified application;
2. an executed Declaration and Power of Attorney;
3. an executed Small Entity Statement;
4. a check in the amount of $385.00 to cover the filing fee; and
5. a stamped, self-addressed postcard.

Kindly stamp and return the postcard to the undersigned upon receipt in the Patent Office of the foregoing items.

Respectfully submitted,

Jean-Marc Zimmerman

Jean-Marc Zimmerman
Registration No. 36,978

JMZ/ds
enclosures
cc: Mr. Bob Riceman

A

Apparatus and Process For High Speed Data Communication

Field of the Invention

This invention relates to devices for transmitting data over a communications line, and more particularly to an apparatus and a process for transmitting data in parallel over a communications line.

Background of the Invention

Devices for transmitting data over communications lines such as modems are well known in the prior art. These devices are commonly used throughout the world to enable businesses, governments and educational institutions to conduct their affairs. They are also being used more commonly in homes throughout the world for personal computing. The use of these devices continues to increase as ever larger numbers of people are communicating on the information super highway.

Although improvements in modem technology enable the speed at which these devices can operate, the process they employ to transmit data serves as an inherent limitation on the top speed they will ever be able to attain. This is because conventional modems transmit data in serial, i.e. one bit at a time, over one frequency. It is, therefore, an object of this invention to provide an apparatus and a process which overcomes this limitation by simultaneously transmitting multiple bits of data over parallel frequencies.

Summary of Invention

An apparatus and method for high speed transmission of data over a communications line, wherein this high speed is achieved by generating multiple tones to enable multiple bits of data to be simultaneously transmitted over parallel frequencies rather than being transmitted one bit at a time over one frequency.

Brief Description of the Drawings

Referring to Fig. 1, there is shown an exemplary embodiment of the apparatus which is the object of this invention.

Referring to Fig. 2, there is shown a flow chart illustrating the process which is the object of this invention.

Referring to FIG. 3, there is shown a drawing depicting how the invention which is the subject of this application operates on bits of data.

Detailed Description of the Figures

Referring to Fig. 1, there is shown a system for high speed parallel transmission of data over a communications line according to the present invention 10. This system is comprised of two identical transmitter-receivers 11 and 21. Transmitter-receiver 11 is comprised of scanner/printer 12, CPU and memory 13, outgoing tone generator 14, mixer 15 multi-line connector 16 and incoming tone discriminators/filters 17.

Transmitter-receiver 21 is comprised of printer/scanner 22, CPU and memory 23, outgoing tone generators 24, mixer/switcher 25, multi-line connector 26 and incoming tone discriminator/filters 27. Device 11 is coupled to device 21 over a communication line such as a standard copper telephone line 30.

There is a limit on the amount of data which can be transmitted over conventional communications lines such as copper phone lines using existing technology. The fastest modems are only able to transmit 56.6 thousand bits of data per second. The present invention allows much greater amounts of data to be transmitted by splitting the tone transmitted over a telephone line into multiple tones, and then using pure tones which when combined form a tone which can be filtered, thereby allowing multiple bits of data to be simultaneously transmitted over parallel frequencies.

The present system is designed to transmit data which can be generated or saved in an 8 bit/byte format or any derivative or multiple thereof. Transmission of the data is based on whether a bit is on or off. Detection on the receiving end is based on either the presence or absence of bit specific tones, while all other tones are filtered out and/or ignored. Once converted back to the 8 bit code, the data is saved for viewing or printing.

Referring to Fig. 2, there is shown a flow chart detailing the process by which data is transmitted according to the present invention. To transmit a document 40 using this invention, the document is first scanned

at 41 and converted to a binary digital signal in the computer's CPU at 42. This stored data is compressed and then stacked/wrapped at step 43. At step 44 this stacked/wrapped signal is then processed so that: the first eight bits processed are stored in a first file, File 1; the next eight bits processed are stored in a second file, File 2; and so on. Alternatively, the data can be processed so that: the first bit of the first byte is stored in a first file, File 1, and the second bit of the first byte is stored in a second file, File 2; and so on such that the first bit of the second byte would then be stored in File 1 and the second bit of the second byte would be stored in File 2 and so on. At step 44 the stacked/wrapped signal is split into eight files with each file being comprised of eight bits. Error check and clocking signals are then created and added as two more files. All ten files are stored in the computer's memory. At step 45 each signal file has added to it a timed start/stop and sequence command to instruct the receiving processor how to read and reassemble the data. The operation of steps 43, 44 and 45 on a single bit of data is shown in FIG. 3.

At step 46 the ten different signal files are sent to ten separate tone generators, which generators create tones separated from one another by the same frequency band width. For example, these ten tones over which the data in the ten files in question are to be transmitted could occur could begin at 500 Hertz, with each successive frequency being separated by 750 Hertz. This designation of frequencies can be implemented using existing

telephone wiring and hardware and will allow for a minimum of 250 Hertz safe zone of separation with generated beat frequencies.

At step 47 the signals from the ten tone generators are combined by the mixer into one multi-tone signal in timed sequence. The mixer overlays the ten tones so that the signal sequence remains in tact in time, i.e. bits 1 through 10 are transmitted and received at the same time, i.e. they leave in alignment and are received in the same alignment. Specifically, when the first bit of File 1 is transmitted, the first bit of Files 2 through 10 are also simultaneously transmitted. Each bit of the 10 tones equals one beat in time.

At step 48 the multi-tone signal is transmitted over a communications line. At step 49 the signal is received. At step 50 the signal is filtered and then sent to the CPU. At step 51 the signal is reassembled. From there signal can either be stored in memory or sent to a printer or other output device.

Using the aforementioned frequency designations, the following frequencies would be used to transmitted data according to the present invention: 500, 1250, 2000, 2700, 3500, 4250, 5000, 6750, 6500 and 7250 Hertz. Beat frequencies (subtractive) generated would be at 750, 1500, 2250, 3000, 3750, 4500, 5250, 6000 and 6750 Hertz. Beat frequencies (additive) generated would be at 1750, 2500, 3250, 4000, 4750, 5500, 6250 and 7000 Hertz. In the foregoing embodiment, additional harmonics would not be closer than 250 Hertz to main frequency.

In addition, all frequencies generated above 7500 Hertz would be filtered out as they would not be used. The foregoing frequencies are representative only. It is, of course, understood that as filter technology improves, the bandwidths which can be filtered will narrow so that less separation between usable frequencies is required, thereby providing more frequencies on which to transmit data.

By using a selected code, the present invention can be used to encrypt the data being transmitted. This can be accomplished by setting the tone to bit numbering scheme differently for each data transmission sequence even to the point of employing a floating encryption based upon a pre-determined algorithm. This would permit data to be securely transmitted without fear that the person receiving the transmission is not the intended recipient as may happen when a wrong telephone number is dialed. Only the intended recipient would have the encryption key required to read and print the document.

An illustrative example of how data would be transmitted employing the present invention over the aforementioned frequency designations is provided below. Transmission of the word "TEST" using straight corresponding bit-dash tone code would occur as follows:

Beginning code (handshake) sent prior to actual document.

T = 84 = 01010100 = 6500 + 5000 + 3500 + a parity type check tone + timing.

E = 69 = 01000101 = 6500 + 5750 + 7250 + a parity type check tone + timing.

S = 83 = 01010011 = 6500 + 5000 + 6500 + a parity type check tone + timing.

T = 84 = 01010100 = 6500 + 5000 + 3500 + a parity type check tone + timing.

End of transmission sequence.

In the foregoing example, all four letters would be sent at the same time on four parallel frequencies and would be re-assembled after reception based on the parody check and timing key sent along with the data.

It will be understood that the embodiment described herein is merely exemplary that a person skilled in the art may make many variations and modifications to the described embodiments utilizing functionally equivalent elements to those described. Any variations or modifications to the invention just described are intended to be included within the scope of this invention as defined by the appended claims.

Claims

I Claim:

1. A method for parallel high speed transmission of data at multiple frequencies over a telephone line, comprising:

creating multiple data files from said data to be transmitted;

generating multiple tones, wherein each one of said tones has a different frequency;

assigning each one of said multiple data files to a corresponding one of said tones;

combining said multiple tones into a single multi-tone signal; and

transmitting said multi-tone signal.

2. A method for simultaneously transmitting multiple data files at multiple frequencies over a communications line at high speed, comprising the steps of:

compressing said data to be transmitted;

splitting said data into eight files;

adding an error check signal as a ninth file to said eight files;

adding a clocking signal as a tenth file to said nine files;

sending each one of said ten files to a separate one of ten different tone generators;

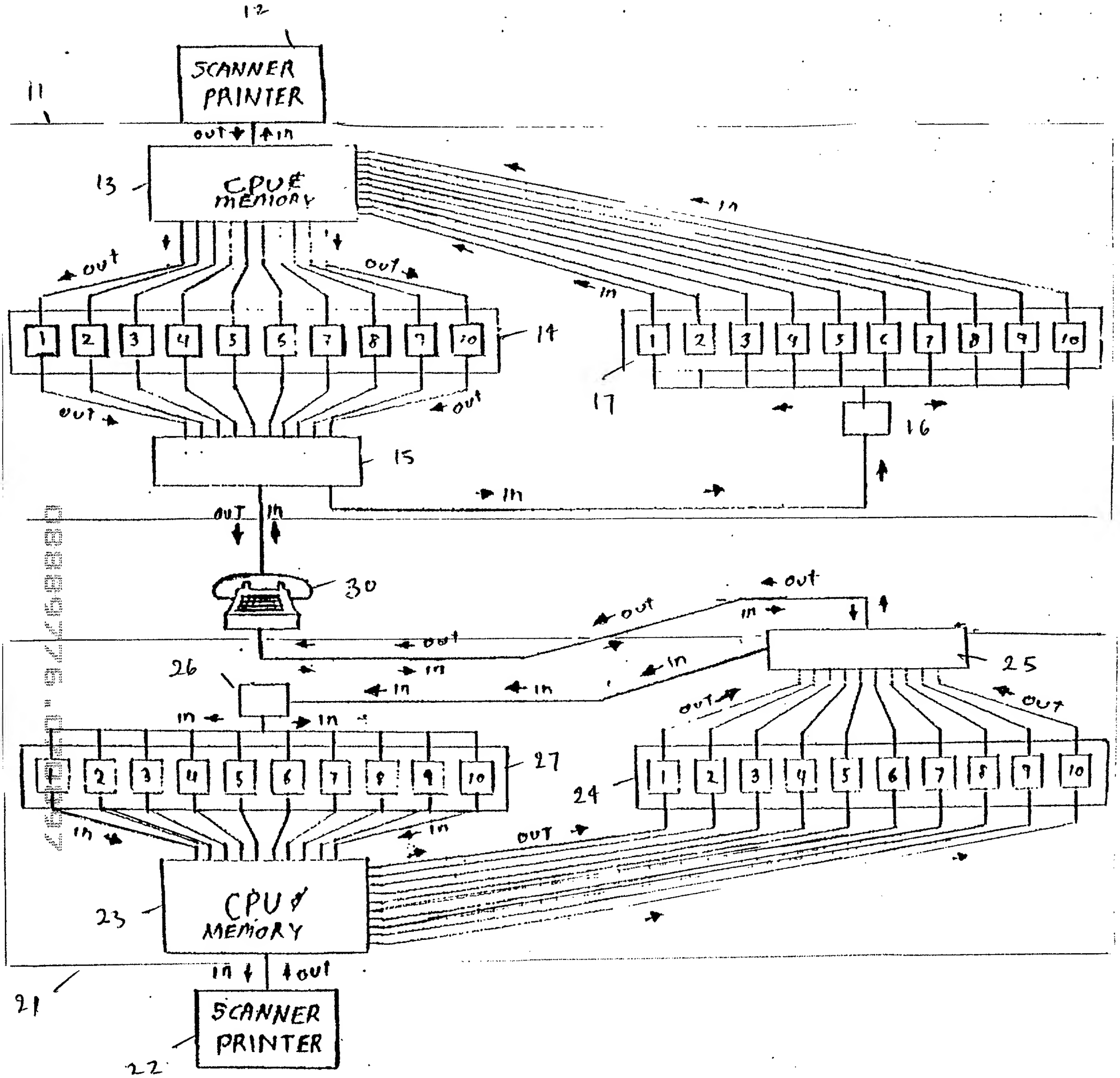
generating a different tone for each one of said ten files, wherein the frequency of each one of said tones are separated from one another by the same frequency bandwidth;

combining said ten tones into one multi-tone signal;

transmitting said multi-tone signal over a communications line.

Abstract

An apparatus and method for high speed transmission of data over a telephone line, wherein this high speed is achieved by simultaneously transmitting multiple bits of data over parallel frequencies rather than serially transmitting one bit of data at a time over one frequency.


12
SCANNER PRINTER
11
out
in
13
CPU & MEMORY
out
out
in
14
1 2 3 4 5 6 7 8 9 10
out
out
17
1 2 3 4 5 6 7 8 9 10
16
15
in
OUT
in
30
out
out
out
in
in
in
26
25
in
in
out
out
27
1 2 3 4 5 6 7 8 9 10
24
1 2 3 4 5 6 7 8 9 10
in
in
OUT
23
CPU & MEMORY
in
out
21
SCANNER PRINTER
22

10

FIG. 1

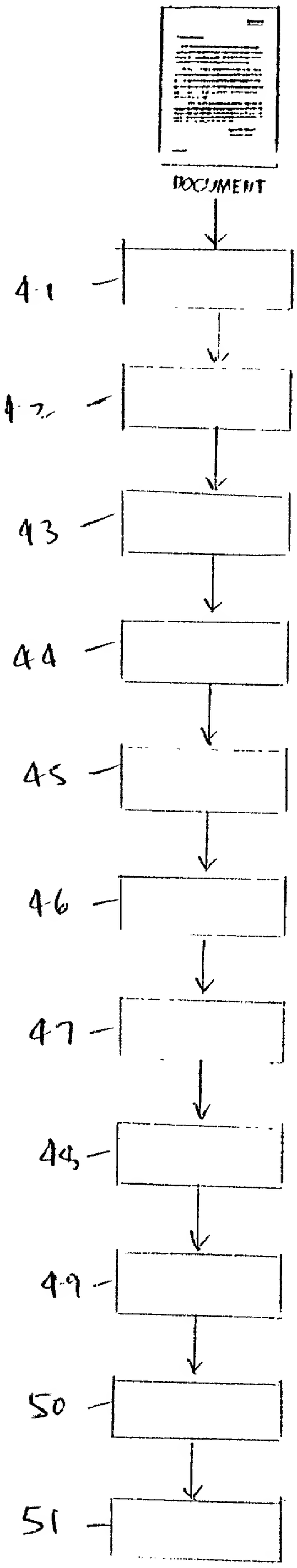
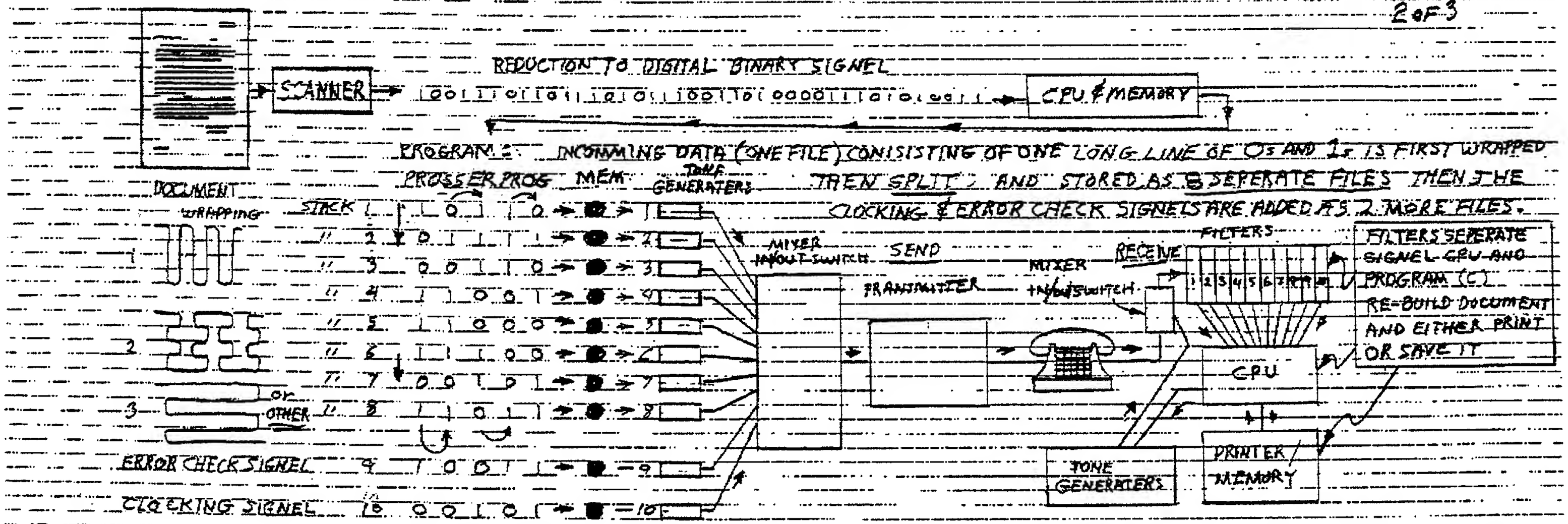


FIG. 2

FIG 3

2 OF 3



PROGRAM (A)

(A1) FIRST PART OF PROGRAM — SIGNEL IS COMPRESSED THEN STACKED/WRAPPED

(A2) SECOND PART OF PROGRAM — SIGNEL IS SPLIT INTO 8 FILES. ERROR CHECK AND CLOCKING SIGNELS ARE CREATED AND ADDED AS 2 MORE FILES. THEN ALL 10 ARE STORED IN MEMORY.

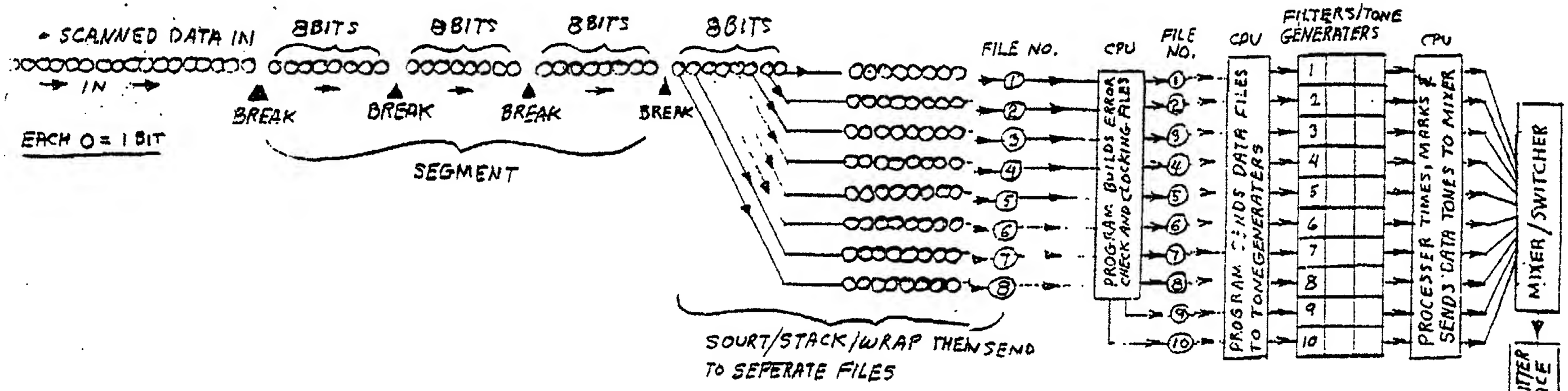
(A3) THIRD PART OF PROGRAM — EACH SIGNEL FILE, THEN (DEPENDING UPON WHICH DIRECTION OF THE STACK/WRAP) IE (8 BITS IN FILE ① THE NEXT 8 IN FILE ② AND SO ON OR 8 BITS LINED UP WITH 1 IN FILE ① 2 IN FILE ② ETC. OR SOME OTHER CONFIGURATION) IS STORED IN MEMORY AND HAS ADDED TO IT A TIMED START/STOP AND SEQUENCE COMMAND WHICH TELLS THE RECEIVING PROCESSER HOW TO READ AND RE-BUILD THE DATA.

PROGRAM (B)

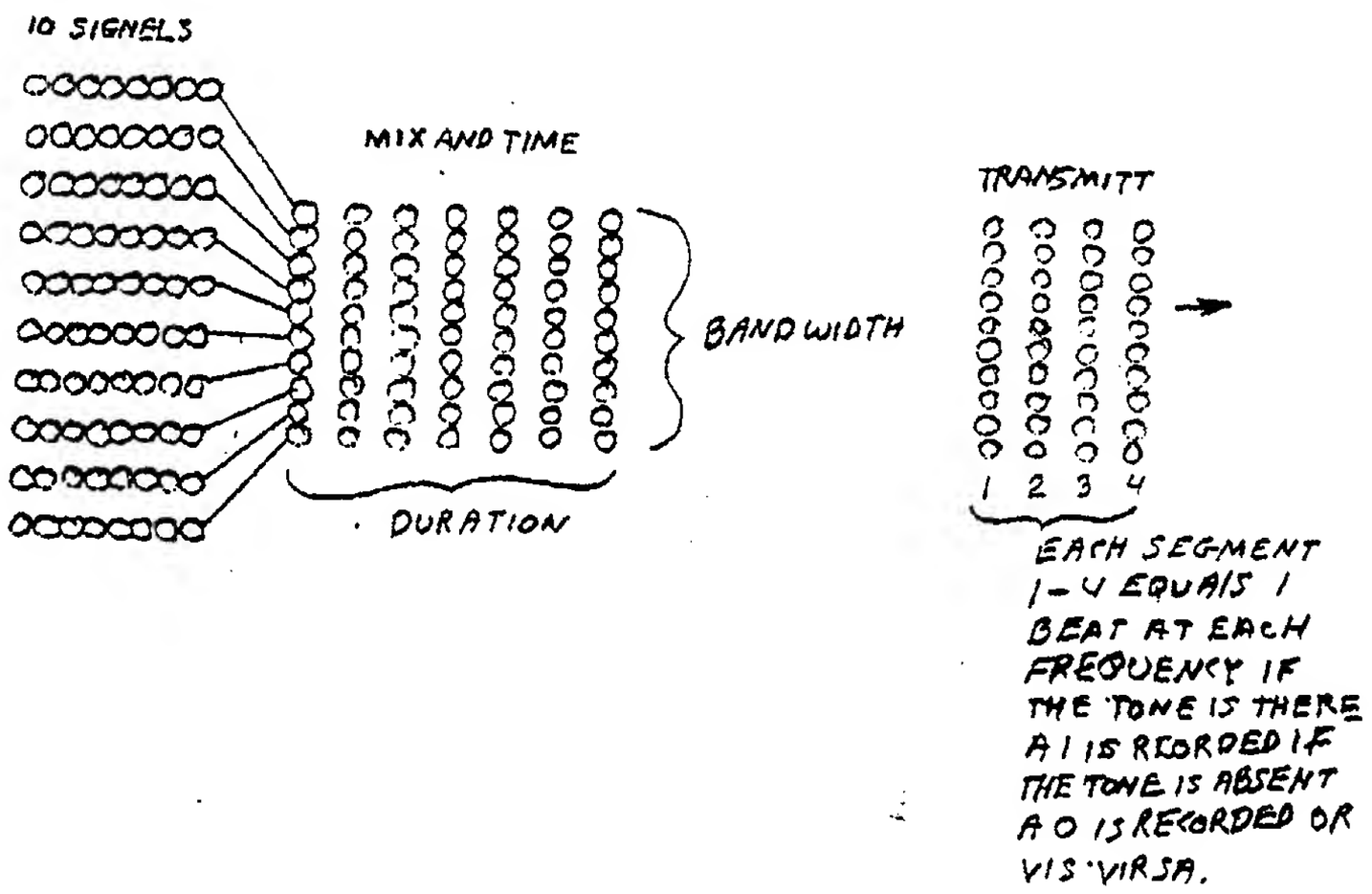
THE SIGNEL FILES ARE THEN SENT TO 10 SEPERATE TONE GENERATERS (EACH FREQUENCY SEPERATED AS PER DESEGNATIONS SENT TO YOU LAST YEAR) THEN THE 10 (OR MORE) DIGITISED DATA TONE SIGNELS ARE SENT TO A MIXER WHICH LAYERS THE 10 TONES, COMBINING THEM INTO 1 MULTI-TONE SIGNEL (IN TIMED SEQUENCE) WHICH IS THEN TRANSMITTED.

SEE PAGE 3

FIG. 3 CONTINUED



MIXER/SWITCHER OVERLAYS THE 10 (or MORE) TONES SO THAT THE SIGNEL SEQUENCE REMAINS INTACT IN TIME ie BITS 1-10 ARE TRANSMITTED AND RECEIVED AT THE SAME TIME (THEY LEAVE IN ALIGNMENT AND ARE RECEIVED IN THE SAME ALIGNMENT) IN OTHER WORDS, WHEN 1 GOES OUT 2-10 LEAVE AT THE SAME TIME AND THEY ALSO ARIVE TOGETHER,



DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled Apparatus and Method for Parallel Transmission of Data Over a Telephone Line, the specification of which is attached hereto, and for which U.S. Provisional Patent Application Serial No. 60/021,345 was filed on July 8, 1996.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclosure information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certification having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

None

I hereby claim the benefit under Title 35, United States Code, Section 1.20 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 1.12, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Prior United States Application(s)

None

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

And I hereby appoint: Jean-Marc Zimmerman (Reg. No. 36,778)

whose address is 226 St. Paul Street, Westfield, NJ 07090 and whose telephone number is (908) 654-8000 my attorney with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Direct correspondence and telephone calls to: Jean-Marc Zimmerman

Full name of first joint inventor: William K. Riesman

Inventor's Signature: William K Riesman

Date: 7/8/97

Residence: 300 East McBee Ave.
Greenville, SC 29601

Citizenship: U.S.

Post Office Address: same as above

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

And I hereby appoint: Jean-Marc Zimmerman (Reg. No. 36,978)

whose address is 226 St. Paul Street, Westfield, NJ 07090 and whose telephone number is (908) 654-8000 my attorney with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Direct correspondence and telephone calls to: Jean-Marc Zimmerman

Full name of ~~sole~~ second joint inventor: Stephen A. Hollock

Inventor's Signature:

Date: 7/8/97

Residence: Road 1, Box 529
Otego, NY 13825

Citizenship: U.S.

Post Office Address: same as above

VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27(b))—INDEPENDENT INVENTOR

Docket Number (Optional)

Applicant or Patentee: William K. Ricenan and Stephen A. Hollock

Serial or Patent No.: _____

Filed or Issued: _____

Title: Apparatus and Method for Parallel Transmission of Data over Telephone Lines

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in

[X] the specification filed herewith with title as listed above.

[ ] the application identified above.

[ ] the patent identified above.

I have not assigned, granted, conveyed or licensed and am not under an obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

[ ] No such person, concern, or organization exists.

[X] Each such person, concern or organization is listed below.

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

William K. Ricenan NAME OF INVENTOR	Stephen A. Hollock NAME OF INVENTOR	NAME OF INVENTOR
William K Ricenan Signature of Inventor	Signature of Inventor	Signature of Inventor
7/8/97 Date	Date	Date

Form and Instruction Order: U.S. DEPARTMENT OF COMMERCE

VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) & 1.27(b))--INDEPENDENT INVENTOR

Docket Number (Optional)

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- [ ] the application identified above.
- [ ] the patent identified above.

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Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- [ ] No such person, concern, or organization exists.
- [X] Each such person, concern or organization is listed below.

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William K. Riceman	Stephen A. Hollock	
NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
Signature of Inventor	Signature of Inventor	Signature of Inventor
Date	7/8/97 Date	Date

Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE